

## PANDANACEAE

NAME: From the genus *Pandanus*, as below.

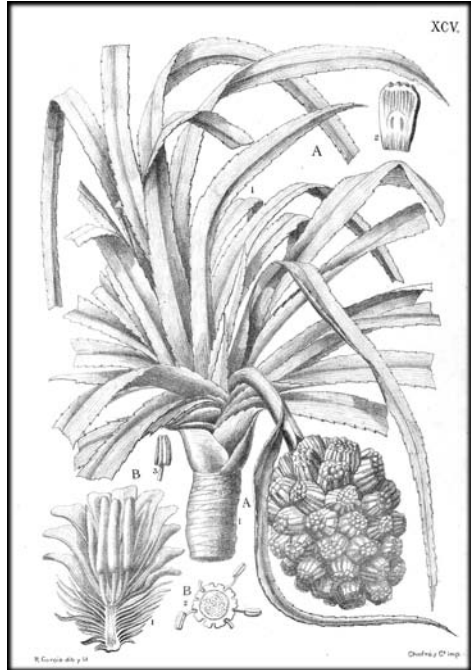
**OVERVIEW:** A paleotropical family of four genera and maybe 600 species. The family is strongly monophyletic and probably allied with the Neotropical Cyclanthaceae. Pandanaceae comprises two clades. The first consists of 400-500 species of short or tall trees in the genus *Pandanus*, these with a distribution from W Africa to the Pacific. The second clade consists of three genera: lianas in *Freycinetia* (maybe 180 species) from Sri Lanka (but not mainland India) eastward to the Pacific, seven species of trees in *Martellidendron* of the Indian Ocean and two species of trees in *Sararanga*<sup>1</sup>.

Pandanaceae are woody plants, trees, shrubs or lianas with long, spiny-toothed leaves. The inflorescence is terminal, the shoot continues growth sympodially by branching below the inflorescence. The flowers have a reduced perianth. All Pandanaceae are all evidently dioecious, but it should be emphasized that there are a great many species and the reproductive ecology is little known for even the more abundant species. Wind pollination cannot be excluded in those few species of the open seashore, but within the closed swampy forests one should anticipate animal vectors. Certainly insects can be seen on the staminate heads which are sometimes odorous. At least in the liana *Freycinetia*, bats and birds are conspicuous pollinators. For most species, no definite information exists on the dispersal of the fruit.

**PANDANUS.** [From the Indonesian name.] In English as the screw-pines, and in Malay languages generally as *pandan* or some variant. The genus includes an uncertain number of species, maybe as few as 400 or as many as 750. Pandans make poor specimens which complicates the determination of the type specimens, or even matching vouchers to a good annotated specimen. Malaya claims about 50 species, about the same in Borneo and 50 again in the Philippines, but very few near the subtropics, with about three in Laos, only *P. odoratissimus* in Taiwan.

Forest pandans are commonly found in swampy forest, such as *Pandanus atroparpus* that can patchily dominate low wet forests in Malaya.

The cultivated species are sometimes badly confused in common literature. *Pandanus utilis* is originally from either Madagascar or the Mascarene islands, but is now a garden plant in much of the tropical world. *Pandanus tectorius* is found on most sandy and rocky shores of the Indo-Pacific region, but is widely planted in Asia as well. (Benjamin Stone, the last authority on the genus, preferred to distinguish two closely related species, *P. tectorius* and *P. odoratissimus*.) These trees are perhaps second only to coconut in economic and social importance to



*Pandanus tectorius*, habit, fruit and flower, adapted from VIDAL loc. cit.

traditional cultures in the Pacific Islands. They are less important in the western parts of Asia where the fruit of wild plants are woody more than fleshy, hardly sweet and often dense with calcium oxalate crystals. Although the specific epithet *odoratissimus* suggests fragrance, this is not the fragrant pandan of Asian cooking. Those leaves come from a small pandan, *P. amaryllifolius*, that is known more or less exclusively in cultivation, and grown everywhere in Asia for flavor. A stalk is placed fresh in steamed rice, or the leaves used as a wrap as in Thai pandan-chicken. A green-colored flavoring is extracted and sold as a liquid essence. The origin of the cultivar is uncertain.

The pandans, rich in species, and filled with ecological and economic significance, need a regional student to advance our field knowledge of the species. Their physiology, reproduction and economic value remain largely unexplored.

**SARARANGA.** [From a native name in Fauro Isl.]

Two species, *Sararanga sinuosa* in the Solomon Islands, and *S. philippinensis* from east coast of Philippine islands from Quezon in Luzon Island and then south to Mindanao<sup>2</sup>.

These are big trees with leaves as much as two meters long. Distinguished in the spirally four-angled leaf arrangement and the open drooping panicle inflorescence, flowers stalked and subtended by a bract, the fruit is a drupe with numerous pyrenes. The Philippine species is distinguished by stellate trichomes, not known elsewhere in the family. (Not illustrated.)

<sup>1</sup>Callmander, M. et al. 2003. Taxon. 52: 747-762.

<sup>2</sup>Stone, B. 1961. Brittonia. 13: 212-224.

# Pandanus



*Pandanus*. 1-3, *P. tectorius*, 1, habit on the shore in northern Luzon, Philippines; 2-3, ripe and unripe fruit in Palawan, Philippines; 4, *P. yvanii*, along a lowland stream at Pasoh, Malaya; 5, the bright red bracts of the blooming pistillate inflorescence of *P. copelandii*, Luzon, Philippines; 6, mature fruit of an unidentified species of *Pandanus*, Mt. Hamiguitan, Philippines. (Photographs 5 & 6, © Leonardo L. Co.)

## RUSCACEAE

**NAME:** From the genus *Ruscus*, a small genus of rhizomatous perennials, scattered in distribution, not so well known as the larger genus *Dracaena*.

**OVERVIEW:** For our purposes, the Neotropical trees that are related to *Yucca* appear distant to a paleotropical clade formed by *Dracaena* and *Cordyline* which in turn seems allied with, on the one hand, the North Temperate herbs that surround *Convallaria*, and on the other, with the mainly Mexican taxa that surround *Nolina*<sup>1</sup>.

Our two genera differ in the number of ovules in each cell of the ovary: *Dracaena* has a single ovule, *Cordyline* has several. Vegetatively, the two kinds of trees are similar. The species of each genus differ most obviously in the size and arrangement of leaves. In many species, the leaves are long and arranged in dense spiral clusters about the growing tip. In other species, the leaves are short, distributed along the branch and twisted more or less into a plane.

**DRACAENA.** [Greek, for dragon; *dragon's-blood* was the name of a dried red plant resin, a name dating to ancient times. *Dracaena* does provide a red resin, but was unlikely the ancient source.] The genus now includes *Pleomele* and *Sansevieria*, and thereby totals about 100 species, many in African and Madagascar, some India to the Pacific, and a single species, *Dracaena americana* in Central America. Mainland SE Asia has more than a few species (see the illustration of the tall *D. loureioides* on limestone in N Thailand in GARDNER *loc. cit.*). Malaya counts 18 species, with fewer species to the east, only three for Kinabalu (the widespread *D. angustifolia* and *D. elliptica*, and one unnamed), and three in the Philippines.

One or another species is found in almost all moist lowland forests of tropical Asia, especially swampy forests. Some are trees that exceed 20 cm DBH. Sadly and surprisingly, there has never been a regional student devoted to these remarkable trees despite the economic value represented by the ubiquitous cultivated species. Certainly, they are hard to name when sterile, and the forest species are hard to catch in flower or fruit.

The inflorescence is terminal, the main axis continues growth by axillary buds, the stem built sympodially. In this they are comparable to pandans and so differ from palms. Pandans differ in their toothed leaves and the distinctive three-sided spiral in the leaf arrangement.

Among forest species, flowering is rare, episodic, synchronized and somewhat explosive. Most species bear small and slender, white-petaled, bisexual, lily-like flowers that and bloom just after sunset, presumably pollinated by moths. The understory tree of Pasoh Forest, *Dracaena trachystachys*, was found to bloom only once over ten years, in June of 1993, when nothing else was in flower and yet every individual of that species bloomed simultaneously.



*Dracaena maingayi*, originally growing in Upper Pierce Reservoir, Singapore, excavated and moved to the Singapore Botanic Gardens. Typical of most monocots, *Dracaena* and *Cordyline* are among the most easily of transplanted trees owing to the capacity for rapid root regeneration. (Photograph © Joseph Lai.)

Like most monocots, individual plants of *Dracaena* can live indefinitely by branching, low or high, from the old axis. The age of old plants would be little more than a guess, but certainly to be measured in centuries. Unlike most monocots, *Dracaena* continue to grow in diameter throughout the life of the stem. The largest of the *Dracaena* species in Pasoh reached a maximum DBH of 17 cm; most trees grew no more than 1-2 mm per year.

The use of *Dracaena* as a source of 'dragon's blood' for medicine is still common, especially in Mainland SE Asia. In Bin Thuan Province of southern Vietnam, the old wood of *D. cambodiana* is collected, the red resin extracted and tonics prepared in alcohol.

**CORDYLINE.** [Greek, club.] About 25 species of the western Pacific Ocean especially New Zealand and eastern Australia. Probably the genus is not native to tropical Asia west of Sulawesi. *Cordyline australis* from New Zealand is the most widely planted of the large trees. *Cordyline fruticosa* is probably native to Sulawesi; a number of varieties are cultivated and it may be naturalized now in scattered locations from the Philippines to India.

<sup>1</sup>Bogler, D. *et al.* 1996. American Journal of Botany. 83: 1225-1235.



1, *Dracaena angustifolia*, northern Luzon, Philippines; 2-3, *D. elliptica*, a small tree in the forest understory, Pasoh, Malaya, 3, a section of the stem stained with iodine, showing the scattered vascular bundles that are generated sequentially by a cambial layer; 4-6, *D. angustifolia*, the Philippines; 4, the 6-petaled flower; 5-6, the flowers still closed at 5:00 PM, and fully open at 6:30 PM; 7-10, cultivated species; 7, *D. marginata*, 8, *D. reflexa*, 9, *D. longifolia*; 10, *Cordyline fruticosa*.

## ARECACEAE

**NAME:** From the genus *Areca*, as below. The traditional family name *Palmae* (not *Palmaceae*) is widely used. The word palm is ancient and of complex origins, including Old English for the open hand, more anciently from Greek *palame*. Latin *palma* was for the tree with hand or fan-shaped leaves, extended to include the feather-leaf palms.

**OVERVIEW:** With 203 genera and 2650 species, the palms constitute one of the most diverse, abundant and characteristic plant families of the tropical world. It is also, within the tropical latitudes, among the most ecologically broad of all plant families with members found in mangroves, seashores, open plains, roadsides, lowland forests and mountains. The image of the coconut leaning out from a sandy shore is iconic of a tropical isle while the date palm equally characterizes the desert oasis. Whether as ornamentals that adorn every tropical household or as crops of the endless tropical plantations, palm trees are unexcelled in combining an elegance of form with a utility to the human economy.

And yet the diversity and abundance of palm trees in tropical Asia is difficult to characterize succinctly. From the hotel lobby out through the manicured landscapes and across the great lowland plantations, palms are ubiquitous and diverse. Indeed, they may be today the most abundant kind of tree in tropical Asia. We might add to the richness represented by palms trees by noting the rattans, which are the most abundant of lianas, and those palms without tall upright stem such as *Nypa* and *Licuala*. But if we restrict our attention to the trees of the mature natural habitats, and especially the species-rich lowland equatorial forest, palms as free standing trees one cm or more in diameter are nearly insignificant. In most of the Sunda Shelf, and also the dry-seasonal lands to the north and west, palms comprise fewer than 1% of the species and 1% of the stems in any forest on dry land, and this bias is even greater when we further limit ourselves to

trees 10 cm DBH and above. At Pasoh Forest in Malaya, palm trees were represented by 7 species of which only 4 exceeded 10 cm DBH, and these occurred at less than 1 tree per hectare. The very rich flora of Mount Kinabalu in Sabah claims 83 species of native palms, but only 22 of these are trees, and only a few reach 10 cm DBH. The survey of 50-ha of mixed deciduous and evergreen forest in Huai Kha Khaeng Sanctuary, Thailand, found not a single palm. Such a poor representation is in sharp contrast with lowland forests of Costa Rica or Colombia or Ecuador where trees such as *Iriartea* and *Socratea* are often among the most abundant species over 10 cm DBH. Indeed, by an unwritten tradition, foresters of tropical Asia simply ignore the family.

We might follow their example so far as presenting a highly abbreviated treatment of the family, a decision that might be further justified by the already extensive literature that is available for the family. And yet a student that ignores the palms will miss out on many opportunities to address fundamental questions of ecology and distribution, diverse culture etc., new ornamentals etc., that it is better to present at least a synoptic outline of the many genera of the palm family. However, rather than add any further general notes on the form and ecology of palms, I will simply point to the main palm literature and sources for further information.

### ☞ - Calamoideae - ☞

The rattans, spiny climbing palms and a few usually stemless palm trees, typically large-leaved and abundant; especially in swampy and broken ground. Only the first develops a strong free-standing trunk.

**METROXYLON.** [Greek, heart-wood, reference to the use of the core for food.] About five species from Maluku to the Pacific with one species, *Metroxylon sagu*, probably native to New Guinea and now cultivated throughout tropical Asia as a source of sago and thatching material. It is widely naturalized in swampy ground. These are short squat palms, the stem with a soft pith full of starch, protected by dense and persistent leaf bases. Stiff feather-leaved, the leaflets with a single-fold, either regular or clustered along the rachis in a fan-like group. The flowers are bisexual.

**PIGAFETTA.** [Commemorates Antonio Pigafetta, 16th century Portuguese traveler with Magellan.] A genus of two species, found in Maluku, Sulawesi, and Western New Guinea. The main species is *Pigafetta elata*, a large fast-growing palm of river banks and alluvium. (Not illustrated.)

Asmussen, C. *et al.* 2006. Botanical Journal of the Linnean Society. 151: 15-38.

Dransfield, J. *et al.* 2004. The Families and Genera of Vascular Plants. 4: 306-388.

Tomlinson, P. 2006. Botanical Journal of the Linnean Society. 151: 113-125.

Tomlinson, P. 1990. The Structural Biology of Palms. Oxford University Press.

Corner, E. 1966. The Natural History of Palms. Weidenfeld & Nicolson, London.

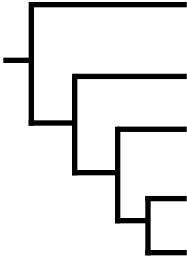
Uhl, N. *et al.* 1987. Genera Palmarum: a classification of palms based on the work of H.E. Moore, Jr. International Palm Society and the L. H. Bailey Hortorium.

The International Palm Society. ([http:// www.palms.org](http://www.palms.org).)

Palmpedia

Guide to Palms.

Phylogeny of Arecaceae

	Subfamily	Diveristy and Distribution	Trees of Tropical Asia
	Calamoideae	21 genera, especially spiny climbing rattans, feather-leafed, overlapping scales cover the fruit.	Rarely trees, about four genera.
	Nypoideae	1 genus, 1 species, feather-leafed, dichotomously branching mangrove palm.	1, prostrate, dominant on mangrove fringe.
	Coryphoideae	45 genera, mostly fan-leafed, plus the fishtails, 3-4 carpels, fruit from 1 carpel.	Many important palms, the fishtails, and the fan palms, <i>Livistona</i> , <i>Licuala</i> (dominant stemless ), <i>Corypha</i> .
	Ceroxyloideae	8 genera, feather-leafed with three fused carpels.	0
	Arecoideae	112 genera, feather-leafed and twice-cut leaves, with flowers in groups of three, a central pistilate flower and two staminate flowers.	especially <i>Cocos</i> , <i>Pinanga</i> , <i>Oncosperma</i> , <i>Areca</i> and many small genera, especially of the Western Pacific.

EUGEISSONA. [Greek, true thatch palm.] Six species, two confined to the Malay Peninsula, and four in Borneo. The genus is morphologically isolated without clear relatives, distinguished by the flowers which are unusually large for palms, and a peculiar sequence of development: first the staminate flower and then later the hermaphrodite flower. *Eugeissona tristis*, known as *bertam* in Malay, is found in a wide range of forest types in Malaya, but is especially abundant on ridge tops up to 1000 m altitude in association with *Shorea curtisii* (Dipterocarpaceae). *Eugeissona minor* is the ‘walking palm’ of Borneo. Although it lacks an elongated stem, the plant is elevated a meter or more above the ground by prop roots.

☞ - Nypoideae - ☞

NYPA. [From the Malay name, *nipah*.] Monotypic, *Nypa fruticans*, an

essentially prostrate palm, hardly a tree by our definition and yet so large and dominant where it occurs that it merits mention. It is found from Sri Lanka to the Pacific Islands. By means of dichotomous branching, *nipah* forms an extensive fringe along quiet waters wherever a river meets the sea. It will not grow along the sandy coasts. The branching is odd, in that rather than form axillary vegetative shoots, the apex forks at regular intervals. Axillary meristems are reproductive. The pollina-



*Metroxylon sagu*, Cuernos, Negros, Philippines; (Color photographs © Leonardo L. Co; black and white photograph adapted from Brown, W. 1922. Minor Products of the Philippines. Bureau of Printing, Manila.)

tion is probably by flies, but comparative studies from different locations would be useful. Flowering is generally after the drier times of year, for most of tropical Asia that is February and March. Almost every part of the *nipah* palm has found a way into the human economy: the leaves were one of the most important sources of *atap*, and also are the traditional paper for cigarettes, still widely sold; sugar is tapped from the inflorescence for



The walking-palm, *Eugeissona minor*, along ridges in Lambir, Sarawak, the stem held meters above the ground by prop roots.

toddy, and for vinegar. It is sometimes cultivated in the Philippines.

#### ☞ - Coryphoideae - ☞

The fan-leaf and fish-tail palms and also the *Phoenix* palms; 45 genera; 3-4 carpels, fruit from 1 carpel. Be careful with identifying cultivated species: many exotic genera of fan-leaf palms are cultivated in Asia.

**CORYPHA.** [Greek, crown of the head, reference to ti great terminal inflorescence.] Six or seven species (depending on the segregation of *C. macropoda*) distributed from S India and Sri Lanka, Indochina throughout tropical Asia to northern Australia. Cultivated and natural, only in fully exposed open lands, especially dry seasonal; rare toward the equator and never in mature closed forests. *Corypha* has a wide range of uses and is intensively exploited. The inflorescence is the largest among seed plants; the number of flowers has been estimated as ten million. Common names include *gebang* and *buri* usually refer to *C. utan* often under the synonym *C. elata*. A century ago, there were over a million trees growing in Pangasinan Province, Philippines, but today it is uncommon. *Corypha umbraculifera* is the widely cultivated *talipot*, native to S India and Sri Lanka, the leaves used as for palm-leaf manuscripts.

**LIVISTONA.** [Commemorates Patrick Murray, Baron Livistone, founder of the Edinburgh Botanic Gardens.] The genus *Livistona* includes 28 species, distributed from East Africa to the Pacific and Australia. Mostly tall graceful palms with broad fan leaves and pendant axillary inflorescences. The genus is distinguished by the gynoeceum of three carpels with fused styles.

The ecology is varied: *Livistona* can be found in peat swamps and upper montane forests, strongly dry seasonal forests to near desert conditions outside of tropical Asia. Species are frequently gregarious, forming attractive small groves along broken waterways, or sometimes along forest ridges. The name *serdang* applies to several species of the Malay Peninsula. In the Philippines, the name *anahaw* is applied chiefly to *Livistona rotundifolia*. The saplings are grown in shaded understory; the leaves collected, dried and used primarily for roofing.

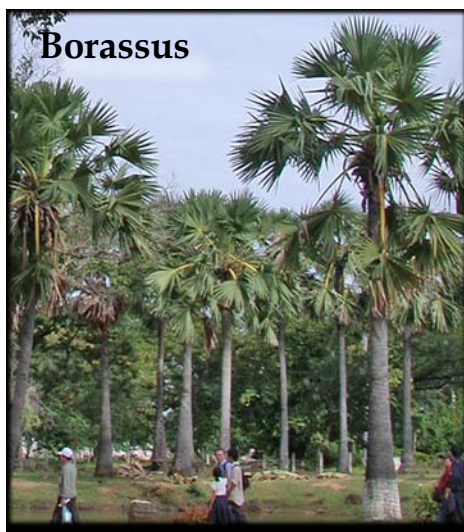
**PHOLIDOCARPUS.** [Greek, scaly fruit.] Six recognized species, but possibly fewer, from south Thailand, throughout tropical Asia to Maluku. Species of *Pholidocarpus* are tall fan leaf palms, sometimes abundant in swampy broken forest, especially after swamp forest is logged. The common name of *serdang* overlaps with the superficially similar *Livistona*. The name *kepau* is sometimes used for the common *P. macrocarpus*. Dis-



*Nypa fruticans*, riverside swamp, Pangasinan, Luzon, Philippines.



*Corypha utan*. Left, in flower, Philippines, © Dr. Edwino Fernando; right, adapted from Brown, W. 1922. Minor Products of the Philippines. Bureau of Printing, Manila.)



*Borassus flabellifer*, cultivated at Angkor Wat, Cambodia.



*Livistona rotundifolia*, growing on the banks of a stream, Mt. Makiling, Luzon, Philippines.



The fan leaves of *Livistona rotundifolia*, tied in overlapping pattern to form a roof that will last 30 years or more; Philippines.



The fan leaves of *Livistonia rotundifolia*, tied in overlapping pattern to form a roof that will last 30 years or more; Philippines.

tinguished by very large smooth or corky-warted fruits. (Not illustrated.)

**LICUALA.** [From a native Moluccan name.] *Licuala* is the most species-rich genus of fan palms with about 108 species, distributed from India and southern China throughout tropical Asia to the Pacific, with species richness centered in Malaya, Borneo, and New Guinea. Only a few species develop a free standing stem and these rarely more than one or two m in height. *Licuala spinosa* is the most widespread species and also one of the tallest. The genus can be recognized by the wedge-shaped reduplicate segment. Those with undivided leaves (e.g., *L. grandis*, *L. orbicularis*) are unlikely to be confused with other palms. Although small in size, *Licuala* species live for decades, perhaps centuries, in the forest understory. The inflorescences are axillary and are produced supra-annually and in synchrony within species. Pollination is by varied insects (calliphorid flies, halictid bees, eumenid wasps, *Trigona* bees). The leaves are used variously for roofing of indifferent quality, and wrapping food, the use driven more by the abundance of the material than by its quality. Many species are decorative, but only a few have been brought into cultivation.

**RHAPIS.** [Greek, not 'needle', rather a cane.] About 12 poorly known species, southern China southwards through Indochina to peninsular Thailand and northernmost Sumatra. Small, clustering, unarmed, dioecious or polygamous palms. The Lady-palm, *R. excelsa*, is among the most widely cultivated palms. The research of Martin Zimmerman, PB Tomlinson and their students at Harvard Forest in the 1970s and 1980s made the



anatomy and physiology of *R. excelsa* better known than that of any other palm, in fact, better known than most any other plants. Yet the field ecology and basic systematics of these small shrubs is virtually untouched.



*Rhapsis excelsa*, cultivated at Mt. Makiling, Luzon, Philippines.

**BORASSUS.** [Greek, from a classical name for the date palm.] Five species, from Africa and Madagascar, to India and Mainland SE Asia to New Guinea and Australia. *Borassus flabellifer* is the Palmyra Palm, exceedingly widespread, mountains and lowlands, a source of Toddy, leaves have been used for writing. A tall solitary dioecious palm. The stem is massive, the persistent leaf bases eventually abscise, the stem ringed with conspicuous leaf scars. Recognized by the large stiff costa-palmate leaves with hastulae above and below, and by the large irregular teeth on the petiole.

**BORASSODENDRON.** [Greek, Borassus-tree.] Two species: *Borassodendron machadonis*, rare in southern Thailand and northern Peninsular Malaysia (photographs on the Flora of Peninsular Malaysia website); and *B. borneense* in Borneo, patchy but locally abundant. Sometimes called *bindang*. The heart of *B. borneense* is edible and is sometimes sold in Bornean village markets. Recognized by the large palmate but deeply split leaf blade, the smooth sharp petiole and adaxial hastula. (Not illustrated.)

**PHOENIX.** [Greek, an early name for the date palm, perhaps from 'red', in reference to the fruit.] About 17 species Europe, Africa, China, Taiwan, Philippines, Malaya and Sumatra. *Phoenix loureiroi* is widely distributed from China, Taiwan to the Philippines. One species, *P. paludosa*, occurs in fringe of mangrove forest. Two species native to Mainland SE Asia are illustrated in THROWER (*loc. cit.*) The genus *Phoenix* is commonly cultivated as ornamentals, while *P. dactylifera*, the date palm, is a significant economic plant in the Middle East, sometimes grown in tropical Asia as an ornamental. Distinguished from all other palms by the induplicate and pinnate leaf with the lower leaflets as spines. (Not illustrated.)

☞ - Arecoideae - ☞

**ARENGA.** [From the Javanese name, *aren*.] About 17 species from India and south China to Taiwan, east to Pacific and north Australia. The greatest diversity lies on the Sunda Shelf. These palms form great quantities of starch in their stems, and then

## #



**PALM SUNDAY** recounts the arrival of Jesus in Jerusalem as told in the Gospel of John. However, the practice of waving palm branches is much older than the Christian Era, and is mentioned in the laws of Leviticus 23:40 "And ye shall take you on the first day the boughs of goodly trees, branches of palm trees, and the boughs of thick trees, and willows of the brook; and ye shall rejoice before the LORD your God seven days." Nowhere is Palm Sunday celebrated with greater enthusiasm or artistry than in the Philippines. Young leaves of coconut and buri are woven into the fantastic shapes that make the traditional *palaspas*. But not only palms are so used, for we find cycads, and *Dracaena*, *Antidesma* and medicinal herbs, all to be blessed, dried and hung in the home for a year.



when they reach large enough size, mobilize this starch as sugar to produce a great axillary inflorescence. Most species are trees of primary forest in the lowlands and hills of the wet tropics. A few species are tall trees. Some of the smaller species were formerly included in *Didymosperma*.

The name Sugar Palm is applied especially to *Arenga pinnata*. Besides sugar it is exploited for wine, fiber and thatch and sometimes for starch.

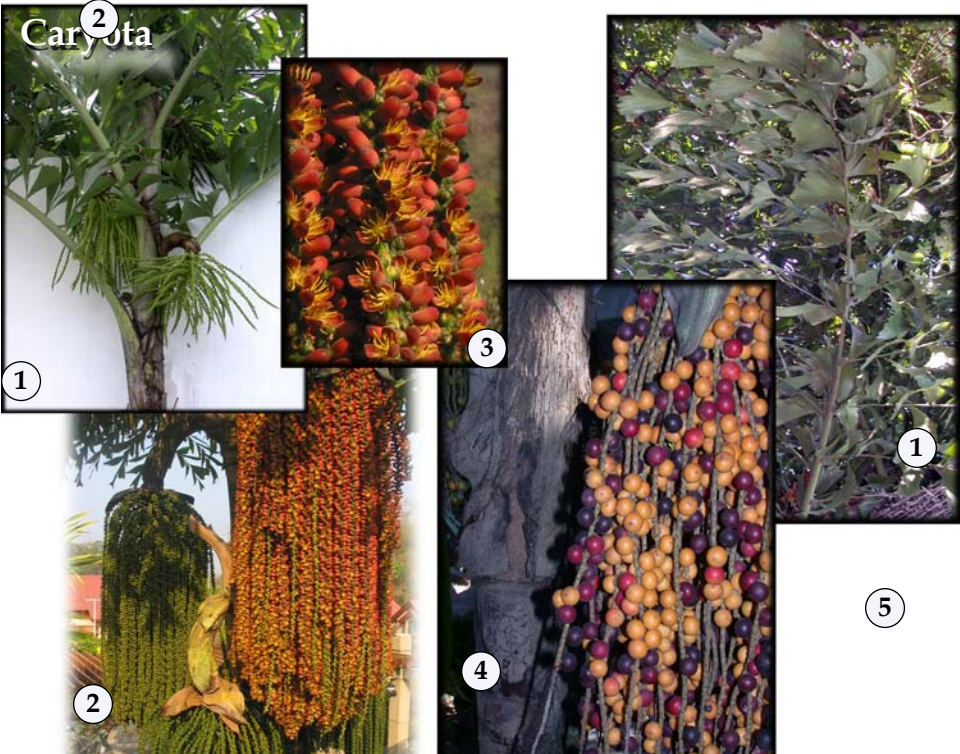
**CARYOTA.** [Greek, ultimately from seed or nut, but also an ancient Greek plant name for a palm different from this.] *Caryota* is a wide ranging genus of about 12 species occurring from Sri Lanka and India to southern China and east to Australia and the Pacific in a diversity of habitats. *Caryota* are the so-called fish-tail palms. They are recognized by their twice-cut leaves with rhombic leaflets and ragged margins.

They can be particularly abundant on we hill slopes. They are exploited extensively starch and especially the heart. *Caryota urens* is tapped for making palm wine or sugar. Many species are cultivated as ornamentals.



*Arenga*. Background, leaf of *Areca* cf. *brevipes*; inset *A. pinnata* in fruit; Philippines. (Photographs © Leonardo L. Co.)

Hahn, WJ & KJ Sytsma. 1999. Syst. Bot. 24(4): 558-580.



*Caryota*, the fishtail palm. 1, cultivated *Caryota* 2-5, *C. cumingii*, Philippines; 2, dense inflorescence; 3, flowers; 4, fruit and stem; 5, leaf with ragged tipped leaflets.

## Areca



*Areca*. 1-2, an unidentified, possibly new *Areca* from Palanan, Philippines; 3-4, *A. catechu*, cultivated, typical appearance, and the cut seeds for sale in market.

**WALLICHIA.** [Commemorates Danish physician and field botanist Nathaniel Wallich, d. 1854, collector, author, administrator of Calcutta Botanic Gardens.] Seven species, from the Indian Himalayas and Burma to China and southwards to peninsular Thailand. (Not illustrated.)

**ADONIDIA.** [From Adonis, the mythical god of beauty.] About 18 species mostly endemic within the Pacific Islands with 10 species in Fiji alone. The most westward species is the most famous *Adonidia merrillii* (widely known as *Vecthia merrillii*), the Manila Palm, native to northern Palawan, Philippines, and cultivated everywhere in the tropics. The Manila Palm is a relatively short solitary, monoecious feather-leaf palm, with a prominent crown shaft, a short leaf stalk. It is a good palm for study in that it is readily available, often simultaneously in flower fruit.

**ARECA.** [Perhaps a corruption of an old Indo-Malayan name.] About 60 species, distributed from India and south China throughout tropical Asia to New Guinea and the Solomon Islands; one species possibly native in Australia.

Although the majority of species are small to moderate palms of the forest understory, the best known, *Areca catechu*, can grow to a very great height. It is among the best known of all palms in Asia, called variously *Betel nut palm* or *pinang*. The endosperm is sliced, dried and

chewed with leaves of *Piper betle*, lime, tobacco. It contains the alkaloid arecaine which acts as a mild narcotic. The practice of betel-chewing is widespread and ceremonial. A few species are minor ornamentals.

## Adonidia



*Adonidia merrillii*, native to Palawan, here cultivated in the Philippines.

**COCOS.** [A Linnaean name, probably taken from Portuguese for monkey in reference to the face-like appearance of the three 'eyes' or pores of the inner husk.] Monotypic, *Cocos nucifera*. Other than the common form of commerce, cultivated varieties include the 'dwarf-golden' form with a short trunk and golden fruit. Native names for the coconut tree and its parts are very numerous. Approximately 90% of the fat found in coconut meat is saturated fat (i.e., saturated with hydrogen bonds), a proportion exceeding that of foods such as lard, butter, and tallow. Not surprisingly, there is a continuing debate among the competitive oil industries as to the relative health benefits of corn and soybean oil versus the oils of palm trees.

**CYRTOSTACHYS.** [Greek, curved spike.] Eight species from New Guinea eastward and one species, *Cyrtostachys renda* (sometimes under the synonym *C. lakka*) in coastal peat swamp forests of Malaya, Sumatra, and Borneo, and also now widely cultivated where it seems not to demand the special conditions that might be expected by the exclusive natural habitat. In cultivated form it is widely known as 'Sealing-Wax Palm'; a common Malay name is *pinang rajah*. In the swamp habitat it is a clustered spineless palm of moderate stature, with a uniquely bright red crown shaft.

**HETEROSPATHE.** [Greek, the spathes covering the inflorescence are of different lengths.] About 32 species from the Philippines and Micronesia to eastern Indonesia and to the Solomon Islands, including 16 species in New Guinea, evidently not in Borneo. These appear to be related *Iguanura* and allies; the species biology is not well-known. Mostly small unarmed palms of forest understory.

**IGUANURA.** [Stylized Greek for Lizard-tail, in reference to the inflorescence.] About 18 species in Malaya, Sumatra and Borneo; these are understory palms, often in wet ground, many local and poorly known, a few abundant wherever they happen to occur. *Iguanura wallichiana* is perhaps the most widespread. As with other small feather-leaf palms, the Malay name is *pinang*. These lack a distinct crown shaft below the leaves.

**NENGA.** [From a Malay name.] A genus of five species distributed from Vietnam and Burma to Sumatra, Malaya, Borneo, and Java. All are small trees of the understory. Unlike *Iguanura*, the palms of *Nenga* usually bear a well defined crown shaft.

**PINANGA.** [From the Malay name.] About 120 species ranging from the Himalayas and south China to



*Cocos nucifera*, above, in a home garden, northern Luzon, Philippines; below, Palawan Island, Philippines.

New Guinea, with the greatest diversity in the wet areas of the Sunda Shelf. Malaya claims 30 species. *Pinanga* is poorly represented in New Guinea. Most species of *Pinanga* all small trees, rarely more than 10 m tall, but often abundant in the forest understory. *Pinanga malayana* is especially dramatic with the candy red fruit and jet black calyx. These are monoecious palms, with a tubular sheath and a well-defined crown shaft. Numerous species often co-occur in the same forest. As illustrated, these trees often bloom quickly with an entire inflorescence blooming in a single evening.

**ONCOSPERMA.** [Greek, for the bulky massive seed.] Five species one endemic to Sri Lanka, two endemic to the Philippines, and two widespread in Mainland SE Asia, Sulawesi, the Philippines, and western Maluku. Tall, usually clustered, spiny palms, leaf sheaths tubular forming a well defined crown shaft. *Oncosperma horridum* is called *bayas* in Malay, a favorite food of elephants despite the dense sharp spines. Elephants will knock the tree over and stamp open the heart; but the tree stump will vigorously coppice and a dense cluster soon replaces the old shoot. *Oncosperma tigillarum* is known in Malay as *nibung*; characteristic of the landward fringe of mangrove forest. Little is known of the natural history of these common palms.

**ORANIA.** [Commemorates William Prince of Orange, later King of Holland, d. 1849.] About 17 species,



*Oncospermum horridum*, Pasoh, Malaya.



*Cyrtostachys renda*, native to Borneo, here cultivated in the Philippines.



*Orania*. 1 & 3, *O. ccccc*, Pasoh, Malaya; 2 & 4, *O. decipiens*, Palanan, Philippines. (Photographs 2 & 4 © Leonardo L. Co.)



*Pinanga*. 1, *P. philippinensis*; 2, *P. malayana*, inflorescence just emerging; 3-6, *P. speciosa*, natively endemic to Mindanao, here cultivated in Los Banos, Luzon; 3, solitary habit; 4, in bud at 6:00 PM, night blooming; 5, 6:00 AM the following morning, all flowers fallen; 6, individual flowers.



*Ptychosperma macarthurii*, native to New Guinea, here cultivated in the Philippines.

distributed in south Thailand, Peninsular Malaysia, Sumatra, Java, Borneo, Philippines, Sulawesi, Maluku, New Guinea, and one species in Madagascar, the greatest diversity occurring in New Guinea, with a minor radiation in the Philippines. These are large, solitary, unarmed palms that lack a crown shaft. Most species are large tree palms of the canopy or subcanopy of lowlands forests, but never especially abundant. The Malay name is *ibul*. The heart is thought to be poisonous.

**PTYCHOSPERMA.** [Greek, box-like seed.] Between 28 and 34 species, chiefly New Guinea and Sulawesi eastward; most species are poorly known, and there are no native species in the Philippines or the Sundaic Region or farther west. The best-known species are the abundantly cultivated Solitaire palm (*P. elegans*), and the Macarthur palm (*P. macarthurii*). These are reported as invasive in Florida.